

Control System, Electronic Device and Method

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to a technology for warning a user of changes in status (a completion of an operation, an occurrence of an extraordinary status or the like) arisen in an electronic device via other electronic devices connected to a network.

10 Related Background Art

 An electronic device for use at a household (electronic device for home use) has been conventionally warning a user of a change in status (a completion of operations, an occurrence of an
15 extraordinary status or the like) using a control element (for example, a light emitting element such as an LED, a displaying device such as a CRT and an LCD, a speaker). A user has been confirming the change in status of the device by visually confirming the control
20 element held by a desired electronic device for home use or by auditorily confirming it.

 However, if a desired electronic device for home use is located in a distant place from a user or is not in a user's room, there is a problem that the user
25 cannot notice the change in status of the device instantly.

 In addition, if a user wishes to know a change in

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arising in the device.

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determining whether the status that should be warned a user of has been released or not after transmitting the warning information to the predetermined device, wherein, if the status that should be warned a user of has not been released, the transmitting unit transmits the warning information to devices other than the predetermined device.

As another embodiment, a method for controlling an electronic device in accordance with the present invention discloses the steps of (a) detecting a status that should be warned a user of, (b) transmitting warning information indicating that the status that should be warned a user of has been detected to a predetermined device connected to a digital network, (c) determining whether the status that should be warned a user of has been released or not after transmitting the warning information to the predetermined device, and (d) if the status that should be warned a user of has not been released, transmitting the warning information to devices other than the predetermined device.

Still other objects of the present invention, and the advantages thereof, will become fully apparent from the following detailed description of the embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings,

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Fig. 12 illustrates changes with time of the operational status of a plurality of electronic devices;

Fig. 14 illustrates changes with time of the operational status of the plurality of electronic devices;

Fig. 16 illustrates a basic configuration of electronic devices connected to the domestic network system;

Fig. 18 is a flow chart showing an example of processing procedures of the domestic network system in the third embodiment; and

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention

will now be described in detail hereinafter with reference to the accompanying drawings.

(First Embodiment)

Fig. 1 illustrates a domestic network system in a first embodiment. 101 denotes a personal computer, 102 denotes stereo equipment, 103 denotes a telephone with a monitor, 104 denotes a digital television receiver (hereinafter referred to as a digital television), 105 denotes an electronic washing machine, 106 denotes a refrigerator, 107 denotes a door phone, 108 denotes a digital video recorder and 100 denotes a digital network conforming to the IEEE1394-1995 standard and its extended standard (hereinafter referred to as IEEE1394 serial bus).

Each of the electronic devices 101 through 108 has the functions for transmitting warning information indicating the occurrence of a status of which a user has to be warned of (i.e., a warning event) to a device that a user registered in advance and for broadcasting the information over a domestic network. In addition, each of the electronic devices 101 through 108 has the functions for receiving warning information transmitted by another device and warning a user.

Fig. 2 illustrates a basic configuration of the electronic devices 101 through 108 composing the domestic network system in the first embodiment.

In Fig. 2, 201 denotes an IEEE1394 interface, 202

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Each of the electronic devices 101 through 108 has two operating modes, an on mode and a sleep mode. The on mode is an operating mode for performing an ordinary operation. On the other hand, the sleep mode is an operating mode with more restricted power consumption than the on mode (what is called a power saving mode). In case of the sleep mode, the control unit 202 stops a part of or substantially all of the functions of the main body unit 204 and reduces power consumption. Each of the electronic devices 101 through 108 automatically switches from the on mode to the sleep mode if no operation is received from a user for a predetermined time or more. Further, in the first embodiment, the case in which all of the electronic devices 101 through 108 are in the on mode is described.

Fig. 3 illustrates a warning function that each of the personal computer 101, the stereo equipment 102, the telephone 103 and the digital television 104 has. In Fig. 3, "O" denotes a warning function that can be coped with and "x" denotes a warning function that cannot be coped with.

Each of the personal computer 101 and the digital television 104 is capable of executing a warning by images, a warning by characters, a warning by voices and a warning by sounds. In addition, each of the stereo equipment 102 and the telephone 103 is capable

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If it is determined that there are registered devices, each of the electronic devices 101 through 108

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If it is determined that there is no registered device (step S403) or if the warning status has not been released until the passage of the predetermined time (step S411), each of the electronic devices 101 through 108 broadcasts the above-mentioned warning command and transmits the above-mentioned warning command to the devices other than the registered devices (step S413).

The device receiving the warning command determines whether a warning by images is possible or not (step S414). If a warning by images is possible, the warning output unit 207 displays still images, animation images and the like representing the type and the contents of the warning event on the monitor using image data contained in the warning information (step S415).

The device then determines whether a warning by characters is possible (step S416). If a warning by characters is possible, the warning output unit 207 displays a text message and the like describing the type and the contents of the warning event on the monitor using text data contained in the warning information (step S417).

The device then determines whether a warning by voices is possible or not (step S418). If a warning by

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refrigerator 106 will now be described with reference to Fig. 7. Fig. 7 is a block diagram describing in details the configurations of the digital television 104 and the refrigerator 106.

5 In Fig. 7, 701 denotes a tuner unit for receiving analog television broadcasting, digital television broadcasting, cable television broadcasting or the like, 702 denotes an image/audio processing unit for processing images and audio signals supplied from the
10 tuner unit 701 or the IEEE1394 interface 201, 703 denotes a monitor for executing a warning by images and a warning by characters, 704 denotes a speaker for executing a warning by voices. In addition, 705 denotes a door sensor for detecting the open and closed
15 status of the door of the refrigerator 106 and 706 denotes a speaker for executing a warning by voices.

 The control unit 202 times the duration of time when the door of the refrigerator 106 opens based on the output of the door sensor 705. After detecting
20 that the door opens for a predetermined time or more, the control unit 202 executes a warning by voices using the speaker 705 and warns a user of the current status of the refrigerator 106.

 If it is determined that the warning status has
25 not been released after the passage of a predetermined time since the beginning of the warning, the control unit 202 reads out warning information held by the

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In Fig. 8, 801 denotes a header portion, 802

805 denotes a destination node ID field and sets a node ID of a destination device. If a warning command is transmitted to a registered device, a node ID of the registered device is set. In addition, if a warning command is broadcast, a code "FFFF₁₆" indicating broadcast is set. 806 denotes a source node ID field and sets a node ID of the device to which the warning command is transmitted. 807 denotes a register address field and designates where in the address space held by the IEEE1394 interface the warning information set in the data portion 803 is sent to.

Fig. 9 explains the timing for transmitting the warning command shown in Fig. 8.

The IEEE1394 interface 201 of each of the electronic devices 101 through 108 executes two types of data transfer method (the isochronous transfer

method and the asynchronous transfer method) in time division. The isochronous transfer method is a transfer method suitable for the transfer of video data, audio data and the like. With the isochronous transfer method, a predetermined amount of data is broadcast at a substantially constant data rate using communication bands and communication channels assigned for each communication cycle (one cycle is usually 125μsec). The asynchronous transfer method is executed between the finish of the transfer period of the isochronous transfer packet and the beginning of the next communication cycle. The asynchronous transfer method is a transfer method for transferring control commands, data files and the like.

In Fig. 9, 901 and 906 denote CSPs (cycle start packets) and are transferred at the start of each communication channel. The CSPs 901 and 906 are broadcast and adjust the time timed by the IEEE1394 interface 201 of each of the electronic devices 101 through 108. 902 and 903 denote packets to be asynchronously transferred. 904 and 905 denote packets to be asynchronously transferred. The warning command shown in Fig. 8 is transferred between the finish of the transfer period of the isochronous transfer packet 902 and 903 and the time the CSP 906 is transferred (i.e., the packet 904).

Further, a warning information is configured to be

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5 (Second Embodiment)

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The control unit 202 of each of the electronic devices 101 through 108 first determines whether a status that should be warned a user of (i.e., a warning event) has occurred or not based on the output of each sensor held by the detection unit 205 (step S1000).

On the other hand, if the warning status has not been released after the passage of the predetermined time, each of the electronic devices 101 through 108 determines that a user is not near by. Then, the device checks the management table of the destination managing unit 209 and determines whether there is a registered device or not (step S1003). In Fig. 12, the stereo equipment 102 is a registered device registered in the refrigerator 106. On the other hand, in Figs. 13 and 14, the digital television 104 is a registered

device registered in the refrigerator 106.

If it has been determined that there is a registered device, each of the electronic devices 101 through 108 transmits a warning command to each registered device (step S1004). Warning information corresponding to the warning event is set in this warning command. If there is no registered device, processing of the step S1015 and the subsequent processing are executed.

The registered device having received the warning command determines whether its own operational mode is the on mode or the sleep mode (step S1005). The registered device determining that the mode is the sleep mode automatically changes its own operational mode to the on mode (step S1006). In Fig. 12, an example in which the stereo equipment 102 being a registered device is in the on mode is shown (S1202). On the other hand, in Figs. 13 and 14, an example in which the digital television 104 being a registered device changes its own operational mode from the sleep mode to the on mode is shown (S1303, S1403).

The registered device having received the warning command determines whether a warning by images is possible or not (step S1007). If a warning by images is possible, the warning output unit 207 displays still images, animation images and the like representing the type and the contents of the warning event on the

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transmits a warning releasing command indicating that the warning status has been released to the registered

device (step S014). The registered device with the sleep mode as the operational mode prior to receiving the warning command changes its own operational mode to the sleep mode again after receiving the warning releasing command (step S1026).

If it has been determined that there is no registered device (step S1003) or if the warning status has not been released after the passage of the predetermined time (step S1013), each of the electronic devices 101 through 108 broadcasts the above-mentioned warning command in order to transmit the above-mentioned command to the devices other than the registered device (step S1015).

The device having received the warning command determines whether its own operational mode is the on mode or the sleep mode (step S1016). The registered device determining that the mode is the sleep mode automatically changes its own operational mode to the on mode (step S1017). In Fig. 12, an example in which the digital television 104 being one of the devices other than the registered device changes its own operational mode from the sleep mode to the on mode is shown (S1304). In Fig. 13, an example in which the

stereo equipment 102 being one of the devices other than the registered device is in the on mode is shown (S1404). In Fig. 14, an example in which the stereo equipment 102 being one of the devices other than the registered device changes its own operational mode from the sleep mode to the on mode is shown (S1405).

The device having received the warning command determines whether a warning by images is possible or not (step S1018). If a warning by images is possible, the warning output device 207 displays still images, animation images and the like representing the type and the contents of the warning event on the monitor using image data contained in the warning information (step S1019). In Fig. 12, an example in which the digital television 104 being one of the devices other than the registered device executes a warning by animation images is shown (S1205).

Then, the device determines whether a warning by characters is possible or not (step S1020). If a warning by characters is possible, the warning output device 207 displays text messages and the like describing the type and the contents of the warning event on the monitor using text data contained in the warning information (step S1021).

Then, the device determines whether a warning by voices is possible or not (step S1022). If a warning by voices is possible, the warning output unit 207

outputs beep sounds, melodies, voice messages and the like corresponding to the type and the contents of the warning event from the speaker (step S1023). In Figs. 13 and 14, an example in which the stereo equipment 102 being one of the devices other than the registered device executes a warning by voice messages is shown (S1305, S1406).

After the warning status has been released, each of the electronic devices 101 through 108 broadcasts a warning releasing command indicating that the warning status has been released (step S1024). The registered device with the sleep mode as the operational mode prior to receiving the warning command changes its own operational mode to the sleep mode again after receiving the warning releasing command (step S1025). Therefore, the device returns to the status of S1201 in Fig. 12, returns to the status of S1301 in Fig. 13 and returns to the status of S1401 in Fig. 14.

As described above, in accordance with the domestic network system of the second embodiment, each of the electronic devices 101 through 108, upon detecting that a status that should be warned a user of (i.e., a warning event) has occurred, can notify a user of the occurrence of the warning event in accordance with the order of (1) the device itself that detected the warning event, (2) registered devices registered in the device that detected the warning event and (3)

electronic devices other than the registered devices.
In addition, each of the electronic devices 101 through
108 is automatically switched to the on mode even if it
is in the sleep mode and can notify a user of the
occurrence of a warning event. With this
configuration, a user in a distant place from a device
can be certainly warned of changes in the status having
occurred in the device.

(Third Embodiment)

In the first embodiment, an example in which a
warning event having occurred in an electronic device
is notified a user of from a registered device
connected to a domestic network. In the third
embodiment, an example in which a warning event having
occurred in an electronic device is warned a user of
from a registered device connected to an external
network.

Fig. 15 illustrates a domestic network system in
the third embodiment.

1501 denotes a personal computer, 1502 denotes
stereo equipment, 1503 denotes a telephone with a
monitor, 1504 denotes a digital television receiver
(hereinafter referred to as a digital television), 1505
denotes a washing machine, 1506 denotes a refrigerator,
1507 denotes a door phone, 1508 denotes a digital video
recorder, 1509 denotes an air conditioner and 1510
denotes a home server. 1500 denotes a digital network

5 utilizing a public network such as a telephone network and the internet, 1512 denotes a network relay station connected to the public network 1511 and 1513 denotes a hand-held terminal capable of communicating with the network relay station 1512.

20 The home server 1510 has the function of
transmitting the warning information transferring the
warning information transmitted from each of the
electronic devices 1501 through 1509 connected to the
domestic network to the hand-held terminal 1513
25 connected to the external network 1511.

Fig. 16 illustrates the basis configuration of the electronic devices 1501 through 1509 forming the

domestic network system in the third embodiment. Each of the electronic devices 1501 through 1509 has the on mode and the sleep mode as in the first embodiment.

In Fig. 16, 1601 denotes an IEEE1394 interface,
1602 denotes a control unit, 1603 denotes a timer, 1604
denotes a main body unit, 1605 denotes a detection
unit, 1606 denotes a warning information managing unit,
1607 denotes a warning output unit, 1608 denotes an
operation unit, 1609 denotes a destination managing
unit and 1610 denotes a switch.

The IEEE1394 interface 1601 is a digital interface conforming to the IEEE1394-1995 standard and its extended standard. The control unit 1602 includes a microcomputer and a storage medium. The timer 1603 times in accordance with the instruction of the control unit 1602. The detection unit 1605 detects changes of the status of the main body unit 1604 using a plurality of sensors. The control unit 1602 determines whether a status that should be warned a user of (i.e., a warning event) has occurred or not based on an output of each sensor held by the detection unit 1605.

For example, in case of the refrigerator 1506, the detection unit 1605 has sensors such as a door sensor and a temperature sensor. The door sensor detects the open and closed status of the door and the temperature sensor detects the temperature status in the refrigerator 1506. The control unit 1602 determines

that a warning event has occurred if the opening status of the door continues for a predetermined time or more or if the temperature in the refrigerator 1506 reaches a predetermined temperature or more. In addition, for example, in case of the air conditioner 1509, the detection unit 1605 has sensors such as a temperature sensor and an infrared ray sensor. The temperature sensor detects the temperature status in the room and the infrared ray sensor detects if a person is in the room. The control unit 1602 determines that a warning event has occurred if the temperature in the room reaches a predetermined temperature or more or if the status with no person in the room continues for a predetermined time or more.

The warning information managing unit 1606 manages a plurality of kinds of warning information. Each piece of warning information includes at least one of image data, text data and audio data representing the type and the contents of a warning event.

The warning output unit 1607 has a monitor (a CRT, an LCD monitor, a plasma display panel and the like) and a speaker, and warns of a warning event having occurred in itself or in other electronic devices by at least one of images, characters and voices. In case of a warning by images, still images, animation images and the like representing the type and the contents of the warning event are displayed on the monitor. In case of

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terminals connectable to the external network 1511 and a management company having a contract with users are registered as transmitting destinations of a warning information. If the hand-held terminals are

5 registered, a priority sequence showing the order of transmitting a warning information, user names of the hand-held terminals, destination numbers designating destinations, passwords for releasing the warning status and the like are input. Each of the electronic

10 devices 1501 through 1509 transmits warning information in accordance with the priority sequence set in each hand-held terminal.

Figs. 17 and 18 are flow charts describing processing procedures of the domestic network system in

15 accordance with the third embodiment.

Each of the electronic devices 1501 through 1509 first determines whether a status that should be warned a user of (i.e., a warning event) has occurred or not based on an output of each sensor held by the detection

20 unit 1605 (step S1700).

If a warning event has occurred, each of the electronic devices 1501 through 1509 warns using its own warning output unit 1607 (step S1701). The control unit 1602 determines whether the warning status has

25 been released or not within a predetermined time (step S1702). If the warning status has been released within a predetermined time, the control unit 1602 finishes

On the other hand, if the warning status has not been released in a predetermined time, each of the electronic devices 1501 through 1509 determines that a user is not near it and, checks the management table of the destination management unit 1609 and determines whether there are registered devices or not with the domestic network (step S1703).

The registered device having received the warning command determines whether its own operational mode is the on mode or the sleep mode (step S1705). The registered device determining that the mode is the sleep mode automatically changes its own operational mode to the on mode (step S1706).

The registered device having received the warning command determines whether a warning by images is possible or not (step S1707). If a warning by images is possible, the warning output unit 1607 displays still images, animation images and the like representing the type and the contents of the warning

The registered device then determines whether a warning by characters is possible or not (step S1709).

Then, the registered device determines whether a warning by voices is possible or not (step S1711). If a warning by voices is possible, the warning output unit 1607 outputs beep sounds, melodies, voice messages and the like corresponding to the type and the contents of the warning event from the speaker using audio data contained in the warning information (step S1712).

Each of the electronic devices 1501 through 1509 determines whether the warning status has been released or not from the time when the warning command was sent to each registered device until a predetermined time has passed (step S1713). If the warning status has been released until the passage of the predetermined time, each of the electronic devices 1501 through 1509 transmits a warning releasing command indicating that the warning status has been released to the registered device (step S1714). The registered device with the sleep mode as the operational mode prior to receiving

If it is determined that there is no registered device (step S1703) or if the warning status has not been released after the passage of the predetermined time (step S1713), each of the electronic devices 1501 through 1509 broadcasts the above-mentioned warning command in order to transmit the above-mentioned warning command to the devices other than the registered devices (step S1716).

The registered device having received the warning command determines whether its own operational mode is the on mode or the sleep mode (step S1717). The registered device determining that the mode is the sleep mode automatically changes its own operational mode to the on mode (step S1718).

The device receiving the warning command determines whether a warning by images is possible or not (step S1719). If a warning by images is possible, the warning output unit 1607 displays still images, animation images and the like representing the type and the contents of the warning event on the monitor using image data contained in the warning information (step S1720).

The device then determines whether a warning by characters is possible or not (step S1721). If a

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5 connected to the external network 1511 (step S1728).

10 each of the electronic devices 1501 through 1509 is once received by the home server 1510 and transmitted to the hand-held terminals 1513 designated by the warning command from the home server 1510.

15 warning command determines whether a warning by images
is possible or not, whether a warning by characters is
possible or not and whether a warning by voices is
possible or not and warns of the occurrence of the
warning event by at least one of images, characters and
20 voices (step S1729).

25 predetermined time (step S1730). The release of the
warning status is performed by the warning confirming
command transmitted from the hand-held terminals 1513.

If the warning status has been released until the passage of the predetermined time, each of the electronic devices 1501 through 1509 transmits the warning releasing command indicating that the warning status has been released to the hand-held terminals 1513 and finishes the processing.

On the other hand, if the warning status has not been released after the passage of the predetermined time, each of the electronic devices 1501 through 1509 checks the management table of the destination managing unit 1609 and determines whether a hand-held terminal 1513 with the second highest priority exists or not (step S1731). If a hand-held terminal 1513 with the second highest priority exists, the processing proceeds to step S1728 and the warning command is transmitted to the hand-held terminal 1513. If a hand-held terminal 1513 with the second highest priority does not exist, each of the electronic devices 1501 through 1509 notifies a management company, a security company, a public organization and the like with which a user has a contract and finishes the processing (step S1732).

As described above, in accordance with the domestic network system of the third embodiment, each of the electronic devices 1501 through 1509, upon detecting the occurrence of a status that should be warned a user of (i.e., a warning event), can notify a user of the occurrence of a warning event in accordance

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(Other embodiments of the present invention)

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For example, although an example in which electronic devices such as a personal computer, stereo

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